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SAP/R3 vs LOTUS NOTES

A description of the two products with analyse of Lotus Notes connection to SAP/R3

Abstract

This master thesis contains a description of SAP/R3 and Lotus Notes with their major features, components, and functionalities. The paper consists of a concise analyse of the underlying principles such as Process-Orientation and GroupWare that the two products are based on. Further this thesis identifies the differences between SAP/R3 and Lotus Notes from the perspectives of architecture, Business Process Reengineering, implementation, and new technologies. I consider SAP/R3 and Lotus Notes to be complementing rather than competing products. That is why I found out that Notes connection to SAP/R3 is an interesting concept for improved information management.

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1. Introduction

Many large organisations use SAP/R3 and/or Lotus Notes for managing exchange of documents inside and outside the organisation. They use SAP/R3 for structuring data and Lotus Notes for collaboration purposes. In this paper I will show how these two products are built and will point out some of the major differences between them. A brief discussion about relations to BPR and implementation issues will be found, and furthermore which new technologies adapt to the two products and finally the subject of supporting collaboration inside companies that are running SAP/R3 (Notes connection to SAP/R3).

1.1. Background

Lotus Notes is the most successful GroupWare product on the market today¹. It is based on Client/Server-architecture and is used by many companies around the world in order to manage and support teamwork and project controlling. SAP/R3 is a Client/Server system too. It is the most famous economy-system today, with work based on Process-Orientation. 'Financial Account' and 'Material Management' are for example some of SAP's processes.

I began to be interested in the combination of both, since this would in my opinion provide a very interesting document managing in large companies with less fear of future adoptions of new technologies.

The concept of connecting Lotus Notes to R/3 System is a new idea. Some companies were working on implementing it during the year 1998. The result of their work will be seen in this year.

1.2. Purpose

The reader of this work will get knowledge about what actually these tools are and a picture of the functionalities provided by them. If the reader represents a company that intends to adopt one of the products, this thesis will hopefully help to give a basic knowledge. But if he or she is interested in combining both of the tools, chapter ten can be of interest.

1.3. Hypothesis

My focus has been in the first place in describing the most significant components of the R/3 system and Lotus Notes. The ensemble between R/3s components, modules, and the application development from within the development environment will give the whole functionalities of the system. In order to understand the system one has to know about the components, modules, and development environment. That is one of the goals that I attempt to reach with this report. By the case of Lotus Notes I describe

¹ F. Ljungberg, Sorensen C. (1995).

the most significant features of Notes documents with the aim of showing how to use Notes documents and the development environment.

I have been working on determination of the differences between the two products, which will appear as significant for Notes connection to SAP/R3.

1.4. Delimitation

Since the area is very extensive, I have to delimit my research and try to present the area in a nutshell. I will not go very deep in technical details, because it is on the one hand really impossible to cover the area with this thesis and on the other hand it is difficult to prioritise and structure the items which I want to study in this work.

There is very little information to find about the combination of Lotus Notes and SAP/R3, therefore, I delimit the work with just that I could get from the Lotus/SAP competence centre.

1.5. Disposition

This work is structured as follows:

1.4. Chapter one is an introduction with purpose, background, hypothesis, delimitation, and disposition.

Chapter two explains briefly some general theories that will appear in this work.

Chapter three covers the sources that I have used.

Chapter four is a description of R/3 System. It is the extensive part of this work and contains a description of the major components of R/3 System and gives an overview of R/3 modules.

Chapter five is a description of Lotus Note System with its major features and ways of use.

Chapter six describes the relevance of R/3 and Lotus Notes system for the Business Process Reengineering Process.

Chapter seven contains in brief a discussion about the implementation issue.

Chapter eight contains a description of some of the new technologies adopted by SAP and Lotus for supporting their basic systems.

Chapter nine is the discussion, in which readers will find the differences between the two products.

Chapter ten describes Lotus Notes connection to SAP/R3.

Chapter eleven contains a conclusion for the whole master thesis inclusive the connection chapter. It is a summary and final result of this work.

Chapter twelve contains the abbreviations.

Chapter thirteen is an index for the abbreviations.

Chapter fourteen is a bibliography of the books and addresses.

2. Frame Of Reference

Readers will meet the following general theories in this work. This section explains them very concisely.

2.1. Business Process Reengineering (BPR)

A business process is the group of activities required to produce a product for customers. Product development process contains a lot of processes such as manufacturing and shipping etc. Any company can be comprised of approximately eight to twelve smaller core processes. The interdependence of these processes is naturally very complicated. BPR is the process of changing the basic business processes with the 50-100 percent rates of improvement²

Hammer and Champy in 'Reengineering the corporation' describe the BPR as fundamental, radical, dramatic business process change. Davenport used the term *Innovation* in his book 'Process innovation: Reengineering work through Information Technology' to distinguish it from the incremental improvement.

IT does play a major roll in the BPR, since it improves the workflow radically, that is why BPR is an interesting issue for both SAP and Lotus.

2.2. Value Chain thinking

In companies today, there are two ways of structuring informational flows of businesses, the old one is the traditional structure and the new one is the process-oriented structure. Figure (1) on the next page illustrates these differences.

“The concept of the value chain was popularised by Harvard Business School professor Michael E. Porter, who describes the value chain as a tool for ascertaining a companies competitive advantage. According to Porter, every firm can be understood as a collection of activities that range from the design, marketing, delivery and support of a product. The value chain breaks these activities down to strategically relevant categories in order to understand behaviour of cost and existing and potential sources of differentiation. By so considering each activity within a company in terms of the value chain, a firm can isolate potential sources of its competitive advantage”.³

SAP/R3 has the following value activity areas:

- Sales and distribution
- Production planning
- Procurement
- Financial accounting
- Business planning and controlling

² Nancy H.Bancroft (1997).

³ Thomas Curran & Gerhard Keller (1998) page 62

- Organisation and human resources management
- Capital asset management.

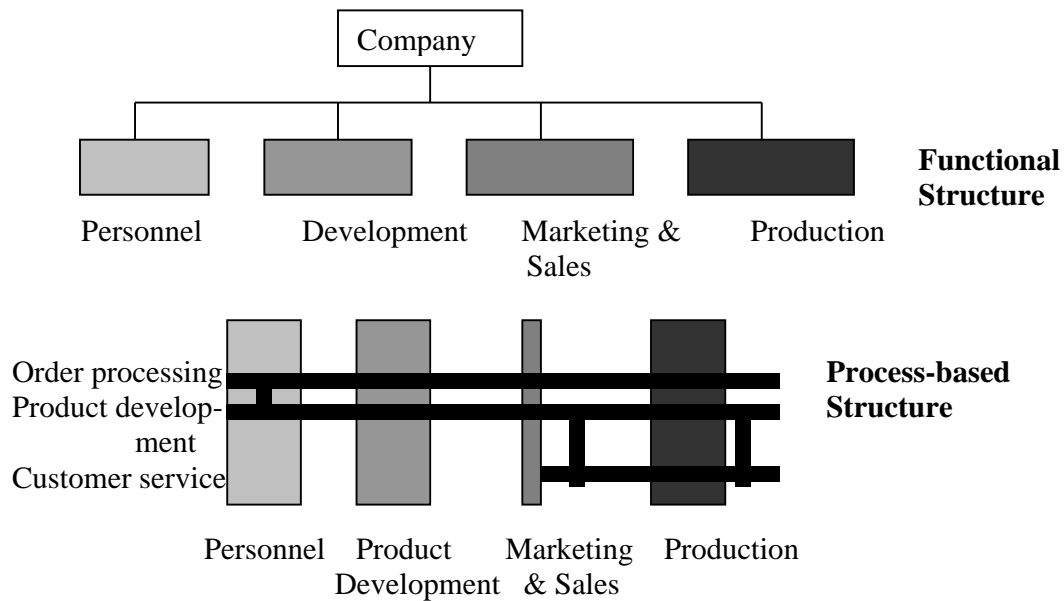


Figure 1 Function- and Process based Structure ⁴

2.3. Using Workbenches

A programming workbench is made up of a set of tools to support the process of program development. It can include the following tools:

Language editor, Structured editor, Linker, Loader, Cross-reference, Prettyprinter, Static analyser, Interactive debugger⁵. 4GL workbenches are environments where users can develop interactive applications that rely on abstracting information from an organisational database. These applications are presented on terminals or workstations where the users can make changes, which will be updated in the database.

The 4GL workbenches have the following tools:

- A database query language like SQL.
- A form design to create forms for input and display.
- A spreadsheet for manipulation of numerical data.
- A report generator for creating reports from the database.

Workbenches support object-oriented design and analysis methods which is particularly important for developing applications by both Lotus Notes and SAP/R3.

⁴ Thomas Gurran & Gehard Keller (1998)

⁵ Ian Somerville (1995).

2.4. GroupWare Technology

CSCW (Computer Supported Co-operative Work) refers to the research area on collaboration and Coordination. GroupWare refers to class technical products and services in the market place ⁶.

According to professor Claudio U. Ciborra the word *GroupWare* includes two distinct elements: a socioorganisational one: the group, a collective way of working, collaboration, the intimacy of staying together and sharing; and the technical one, the *ware*, the artefact and the tool. The term GroupWare connects the two words, the one of human, collective endeavour, and the artificial one of the artefact ⁷.

The GroupWare products and services have in common that they support and facilitate human interaction and collaboration through computer networks. The term GroupWare covers IT-products that are built on pure E-mail system (mobile data, picture telephony, etc) and other that support the new way of working that emerges in groups and organisations ⁸.

GroupWare is simply a tool that helps people work together more easily or more effectively. It allows them to communicate, coordinate, and collaborate. Other names sometimes used for GroupWare include collaborative computing or Group Support Systems (GSS). GroupWare encourages the free flow of information, which enhances innovation and supports and facilitates collective leadership to meet today marketplace challenges. It supports people working together in-groups and teams. These tools let people work together more easily *if* they want to work together.

On the market we can find products that support the following types of GroupWare:

- Calendering and Scheduling
- Voice Conferencing and Videoconferencing
- Electronic Meeting Systems
- Whiteboards and Data Conferencing
- Chat
- E-mail
- Conferencing and Newsgroups
- Knowledge Repositories
- Group Writing and Shared Editing
- Workflow

⁶ Ulf Essler (1998).

⁷ C.U. Ciborra (1996).

⁸ Ulf Essler (1998).

3. Method

The method I used for doing this work was visiting home pages, literature studies and contacts with the Lotus/SAP competence centre in Germany. Information I got from the competence centre was mainly about Lotus Notes connection to SAP/R3, and a few links to interesting home pages that are related to the work. It was possible for me to get the latest news from SAP when I became a member of “SAP-Flash”. They send an electronic report with news and links to their own home page and to partners and others.

By Lotus, to download documents people have to be members, so I became a member and that allowed me to download a number of documents. There is a newsletter generated by Lotus, it covers the latest in the development. In August, I received the first one.

3.1. Literature Analysis

In the market there are more than 50 books about R/3 and the like about Lotus products, especially Notes.

In the library of the Chalmers University, I found ‘The SAP/R3 handbook’, this book contains a number of pictures from the R/3 environment. It was written in 1997. In this book I found very good explanations of the basic R/3, but there was little about the R/3 and the Internet and nothing at all about Java.

I found on the market two other books. The first one deals with the implementation and the other has the title ‘SAP/R3 business blueprint’ from the year 1998. It analyses R/3 deeply from the business viewpoint.

About Lotus Notes, I found in the same library a book with the title “Mastering Lotus Notes”. In this book we can find almost everything about Notes from the technical point of view.

Other books I read were those that handle the GroupWare technology in general, but they all take Lotus Notes as a representative product for the GroupWare technology. I read two doctoral works too, both deals with the implementation of the GroupWare technology. Another one is the book with the title ‘Transforming Organisations Through GroupWare’. This book handles Lotus Notes from the BPR perspective.

The same amount of papers I could download from the homepages. Articles and books from SAP deal with R/3 in more detail and the latest in the technology. These articles are changing continually and are becoming more and more daily. Many articles and papers are still not finished, most of them deal with Java, CORBA and other new technologies.

3.2. Visiting home pages

This is the other way that I took to study the problem. Visiting SAP's home page means months of work. A huge amount of information is to be found on this home page, articles to read directly or for some months ago (today is September 1998) it was to download books, or articles, today the Acrobat Reader is embedded in Netscape, it opens the article directly. There was less to find on Lotus home page compared to SAP's home page. SAP's documents, which can be downloaded, are always with many pictures and less text.

On both homepages one can find a search button, clicking on it gives the opportunity to search after a word or a phrase. This is very helpful, it speeds the search process really much. But there is a risk of ending up in *Information Junk*. When I tried to find documents about for example 'SAP/R3 and Lotus Notes', I got 2700 of them.

It is really very nice to have these homepages as a workplace, whenever I needed to know something about a subject, I just needed to open Netscape and to find the appropriate information.

4. SAP/R3 Description

In this chapter, one finds a description of the major features and components of the R/3 system, such as the Three-Tier Client/Server system, Reference Model, Data Repository etc. The chapter gives a general idea about the R/3 basic system.

4.1. What is SAP/R3

SAP stands for Systems, Applications and Products in Data Processing. It is the name of the German company based in Walldorf, Germany. R/3 is a program package developed by SAP. It is an open Client/Server system that was developed in the late 80's by SAP from the R2 which was developed for mainframe computers in the 80's. R/3 is the market leader in the Client/Server- Architecture and has over 4500 installations in Germany and 1500 in the USA and is functioning in more than 40 countries. The modules within R/3 contain four major elements: financial accounting, human resources, manufacturing and logistics, and sales and distribution⁹. Each module accesses over 1000 business processes encompassing many things from corporate structure to pricing discount. The latest release is the version R/3 4.5 (July 1998).

4.2. R/3 Value Chain

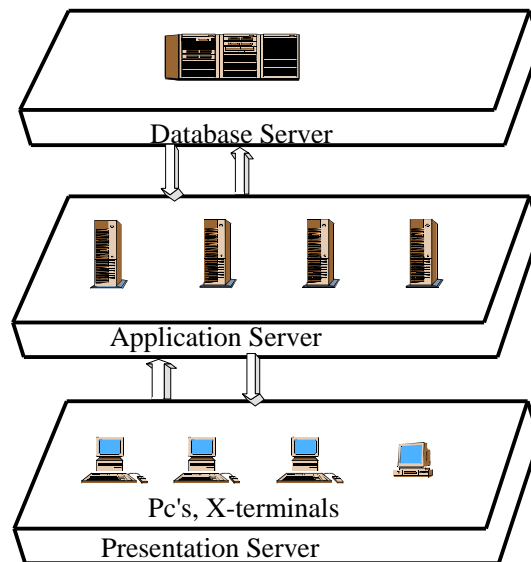
Everything that a company does can be categorised into primary and support activities. Starting with these generic value chain categories, a firm can then further subdivide each category into discrete activities.

SAP's strategy is to integrate all business operations in an overall system for planning, controlling, and monitoring a given business. This allows companies to restructure their business activities along the value chain principal. To help facilitate the restructuring of company processes according to the value chain principle, SAP has included a huge number of scenarios in the Business Blueprint. These scenarios provide logical models for the optimisation of specific business processes and can be modelled around the value activities. For example, SAP provides detailed scenarios of such primary activities as Material Management, Sales and Logistics, Purchasing, and the like. Support activities include Human Resources Management, Business Planning and Controlling, Capital Asset Management, and so forth.

⁹ Nancy H. Bancroft (1997).

4.3. The Three-Tier Client/Server-Architecture

The Three-Tier System consists of three components: Presentation, Application, and Database. Each group is set up to support the demands of its functions. The central server contains the database. The application server includes the processing logic of the system. The presentations server enables the access to the system (see figure 2)



Figur 2 R/3 Three-Tier Client/Server Architecture¹⁰

¹⁰ José Antonio Hernández (1998).

4.4. The classical Presentation Layer

Figure 3 shows the classical presentation of the R/3 kernel system, which provides the necessary integration and infrastructure for the R/3 system.

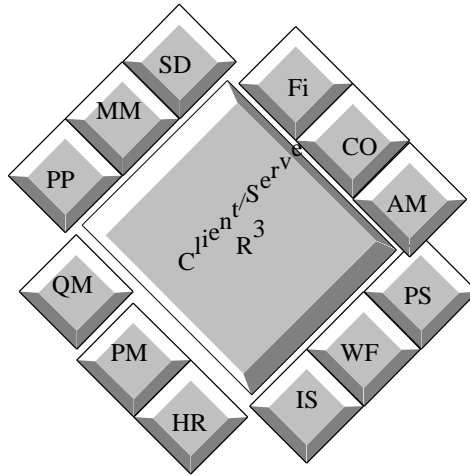


Figure 3 R/3 Classical Presentation Layer¹¹

FI : Financial Accounting.
CO : Controlling.
AM : Fixed Assets Management.
PS : Project System.
WF : Workflow.
IS : Industry Solutions.
HR : Human Resources.
PM : Plant Maintenance.
QM : Quality Management.
PP : Production Planning.
MM: Material Management.
SD : Sales & Distribution.

4.5. Overview of Modules

The overview of R/3's modules can be organised in different ways, the following overview of the modules was given in the literature ¹².

¹¹ José Antonio Hernández (1997).

¹² Nancy H. Bancroft (1997).

4.5.1. Financial Accounting

SAP modules in the financial accounting area are the following:

- FI : Financial Accounting.
- CO: Controlling.
- EC : Enterprise Controlling.
- IM : Capital Investment Management.
- TR : Treasury.

FI: This module constitutes the operational aspects of the general accounting and financial information for the enterprise. The module is connected and integrated with other financial modules such as Controlling and Human Resources. Transactions of account receivable and account payable are functions of this module.

CO: This module represents enterprise cost structure and the factors that influence it and such areas as cost controlling and production cost controlling, profitability analysis. Questions like, what does a product or service cost will be answered by this module.

EC: This module is very important for decision-making because it is used for delivering of information concerning critical success factors and key figures of the company from the controller's point of view. Data from different countries about legal regulation is gathered in this module.

IM: With IM-module, companies can plan and manage capital investment projects. Orders can be managed in this module too.

TR: This module can be used for cash management related to financial and logistics applications. The module has the following components:

- Funds management
- Cash management
- Treasury management

4.5.2 Human Resources (HR)

Managing human resources is a very important part of the organisations today. The idea is to enter data about the staff once and let it be available to other applications such as workflow, accounting etc.

R/3's support for human resources is divided into the following areas:

- Personal administration with support for application management, benefits, personal, administration, incentive wages, payroll, time management, and travel expenses.
- Personal development with support for organisational management, personnel development, room reservations planning, seminar and convention management, and workforce planning.

4.5.3 Manufacturing and Logistics

This is the largest and most complex module of the R/3 modules. The module is divided into five major components:

- MM : Material Management.
- PM : Plant Maintenance.
- QM : Quality Management.
- PP : Production Planning and Control.
- PS : Project Management System.

MM: In this module, it is possible to compare all activities related to purchasing and control (Inventory, Warehouse). In the Inventory, it is possible to compare materials ordered with those received. The Warehouse manages information about transportation routes since it is connected to the sales and distribution modules and capital investment.

PM: In this module, all activities to repairs and preventive maintenance are covered completion and cost reports are available.

QM: This module handles the tasks in quality planning, inspection and control, and companies with internationally defined standards on quality. The main tasks of QM have to do with quality control of the sales and distribution processes, the materials management, and all production-related issues.

PP: This module is very complicated and extensive. It contains modules for the different phases, tasks, and methodologies used in the planning of production (product quantities, product types, materials procurement, time, etc) and the process itself. This module also enables the connection with external plant control systems and the management of different plants.

PS: This module provides the users with the ability to set up, manage, and evaluate large, complex projects. It is used for planning and monitoring dates and resources. It takes users through the projects all steps-concept, rough-cut planning, detailed planning, approval, execution and closing.

4.5.4 Sales and Distribution (SD)

This module provides prospect and customer's, sales order, configuration, distribution, expert controls, shipping, and transportation management, billing, invoicing, and rebate processing. All these can be implemented on global basis.

In this module, products and service are sold to the customers. The structure of the company must be presented in the R/3 so that R/3 knows when and where to recognise revenue. Further, it is possible to represent the structure of companies from the accounting, materials management, or sales and distribution, point of view. When sales order is entered, it automatically includes the correct information on pricing, promotions, availability, and shipping options. The module is built in a way that it can use *best practices*, the most efficient and effective way to complete processes. After a while of using, companies can develop this module to fit their needs.

4.6. The Reference Model

SAP/R3 Business Navigator provides two different views, a business application view or a process flow view of the structure of R/3 that is called the Reference Model. The Reference Model is a collection of predefined business processes with a description of each functionality. It is the atlas to R/3. Every team that wants to use R/3 can choose and modify the appropriate (event-driven) processes from the reference model to fit the needs of their business.

4.7. The Data Repository

The Data Repository or Data Dictionary is a central source of information about a company's data. In the data repository one can find the answer to the following questions:

- What data does the corporate database contain?
- What are the attributes of this data?
- What relationships exist between the different data objects?

The Data Repository is embedded within the development workbench and serves with entering, managing and evaluating information about the company. It is in this sense an active repository and provides always up-to-date information for language interpreters, report functions, and screen generators, as well as to certain tests.

4.8. The ABAP/4 Workbench

SAP has its own software development environment called ABAP/4 Workbench. The workbench contains of a set of tools that are:

- **The ABAP/4 Repository**

The repository is a catalogue of all information within the ABAP/4 Workbench. All information about data and process models, programs, tables, fields, projects, a change requests etc, including their location, are kept here so that nothing will be lost in the system. To navigate the repository expertise and business people can use a navigator with a simple graphical user interface that helps them to find the appropriate code and data.

- **The Application Hierarchy**

The Application hierarchy is another navigator that helps you in finding code and data. The developer (user of the workbench) can enter the data using SAP-applications (for example FI, MM etc.) as an entry point.

- **The Object Browser**

The Objects Browser is another navigator that supports you in navigating through the ABAP/4 repository. The developer gets access to a lower level of objects when he or she uses this navigator. As an example, it is possible for the user to find components of a program quicker when he or she knows the name of it.

- **The Data Modeller**

SAP/R3 contains about 8000 tables based on the relational database model. In order to get an overview and navigate the model, the Data Modeller can be used. The user starts from the highest level, for example FI, MM, etc. and drills down to the data model. This tool enables users to develop their own data model and then link it to the general SAP data model.

- **The Data Dictionary**

The ABAP/4 Data Dictionary is the tool that contains information about the structure of SAP databases, this includes Tables, Data elements, Domains, Views, and Match code. The ABAP/4 Data Dictionary helps you in solving the problem of the data integrity.

- **The Programming Language and Editor**

SAP software development tools are the ABAP/4 programming language and editor, screen painter, menu painter, data browser, and test aids. The Editor checks the syntax of the code without leaving the editor. The screen painter allows users to define their own attributes to develop screen fields.

ABAP is an extensional Object Oriented Programming (OOP) language. It uses the OOP's principles of encapsulation, inheritance, and polymorphism and supports real object-oriented development. This results in improvements in the areas of reusability, maintenance, and quality of code. ABAP objects concepts are:

- Classical Object model (like C++, Java,...).
- Attributes, methods and events (instance and class-level).
- Single inheritance for classes.
- Interfaces, nested interfaces.
- Integration with GUI.
- No method overloading.
- Garbage collection.
- Hybrid language.

4.9. The Business Object (BO), Object Model, Business Object Repository

SAP uses the object-oriented approach by defining a lot of Business Objects (BO) that will represent the activities in organisations for example 'sales order', 'customers' etc. This makes the software more comprehensive and gives the ability to group objects that have similar characteristics.

The object model describes how these objects interact with each other and how they can be accessed from inside or outside the SAP system.

The business object repository is one of the core parts of the SAP system. It works as a general container of business engineering information. It contains a comprehensive description of the R/3 application, including all metainformation about models, technical programming objects, and business objects. The repository contains further

information about R/3's applications including new development, design, and maintenance of applications and other components.

4.10. The Business Framework

In order to meet a company's requirements in following the technological changes and the integrity of many components, SAP has developed a Framework where companies can combine individual components such as ' Human resources', ' Consolidation', and so on, even if they are not from the same R/3 release. This means that companies will not be forced to upgrade other components when they want to upgrade a certain component. In order to manage this issue, SAP uses the following technologies:

- **Business Components**

A Business Component supplies a dedicated, encapsulated business functionality via stable interfaces. A component of this type has its own development, implementation and maintenance cycles. A number of these components can run on their own dedicated databases.

- **BAPI : Business Application Programming Interfaces**

The BAPI are open, object oriented interfaces which permit the communication between software components. They enable R/3s business processes to be accessed easily irrespective of the programming languages and communication mechanisms (for more information see page 36).

- **Integration Technologies**

With SAPs Business Workflow and the Application Link Enabling (ALE), Business Components can be integrated. ALE enables Business Components to be remotely integrated irrespective of the release for example, a companies head office in Europe, its Sales and Distribution division in the USA and one of its plants in Australia could each use a separate R/3 system (for more information on ALE see page 34). Reliable, message-based integration is made possible by ALE even if releases of the systems are different. (See figures on the next page)

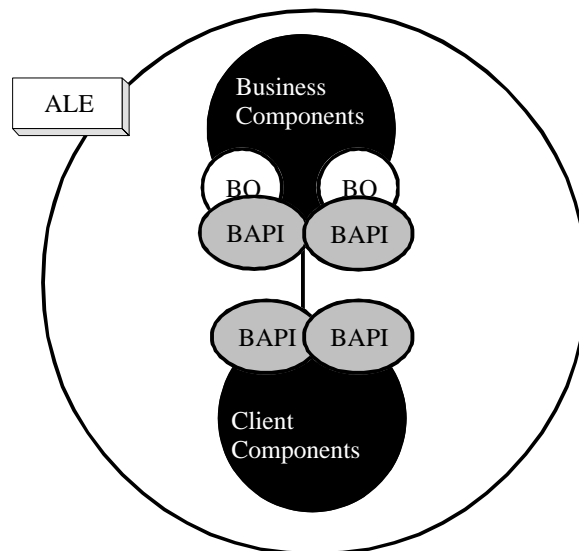


Figure 4 The Business Framework¹³

4.11. Business Information Warehouse

The Data Warehouse is a new technology that is used by companies in order to support their decision-makers. It is used for arranging up-to-date information about the business situation and its environment. SAPs Information Warehouse is a part of the Business Framework. It is a separate application environment with a dedicated drawing on diverge data sources and designed to support query and analysis. The following features are the characteristics of the SAP/R3 Information Warehouse:

- It is a read-to-go data Warehouse solution. It includes a relational OLAP processor, automated data extraction, a pre-configured meta data repository, a user friendly front-end *Business Explorer*, and administrator's workbench.
- Data can be gathered automatically from R/3, R2 and from external sources via open interfaces.
- It includes a central administration tool.
- Pre-configured information models and reporting help in generating reports quickly.
- It allows creating custom documents on the basis of Business Information Warehouse report views.
- It supports pre-defined standard reports and ad hoc analysis.
- Users can define their own collections of favourite reports.
- It is built for high performance.
- It embodies the advantages of R/3 basis technology with its three-tier architecture: Security, Integrity, Scalability, high availability and interoperability within a homogeneous environment.
- It includes an enterprise model for the application of business rules to data.

¹³ www.sap.com (1998).

- The Business Programming Interfaces (APIs) enable Business Information Warehouse to be rapidly integrated into the existing computing environment and allow tools to be added (See next figure).

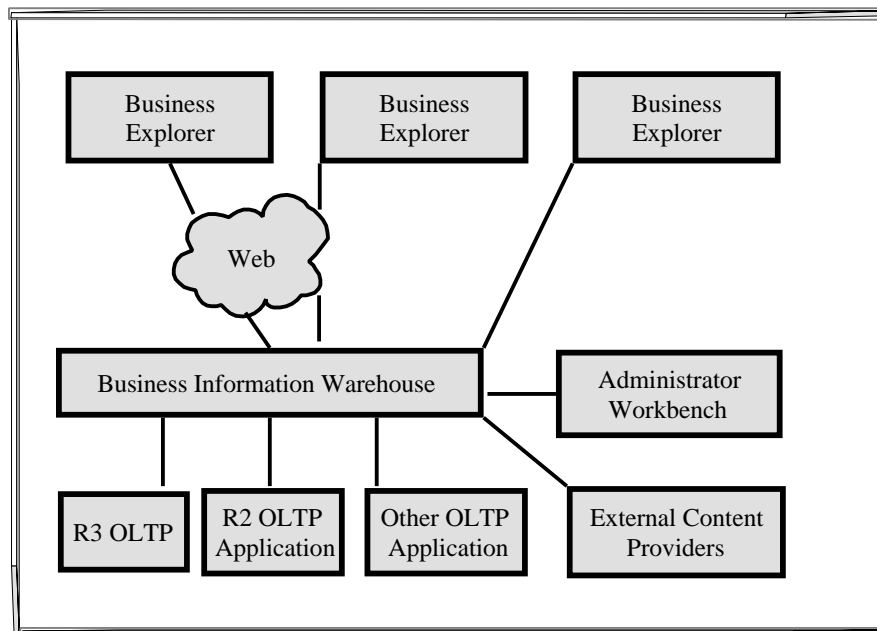


Figure 5 Business Information Warehouse¹⁴

4.12. SAP Business Workflow

The traditional workflow has automated isolated business processes within specific departments or applications. SAP Business Workflow provides the infrastructure and tools to allow business processes to be managed, automated, and analysed as related entities across the entire company.

SAP Business Workflow views business processes from the perspectives of:

- How the process is related to the business,
- How the organisation is related to the processes.

It has the features of automating information and process flows, active linking of work steps, and flexible implementation of the organisational structures. Individual work processes are linked with the R/3 system business processes to provide employees with information, data, and documents required to make business decisions on a timely basis. The interface between Workflow Management and the application functions in the various steps is based on the object-oriented principles. The Workflow Definition is the way SAP uses to define the technical aspects of the business process. The workflow definition regulates the active control and data flow between the processing steps.

¹⁴ www.sap.com (1998).

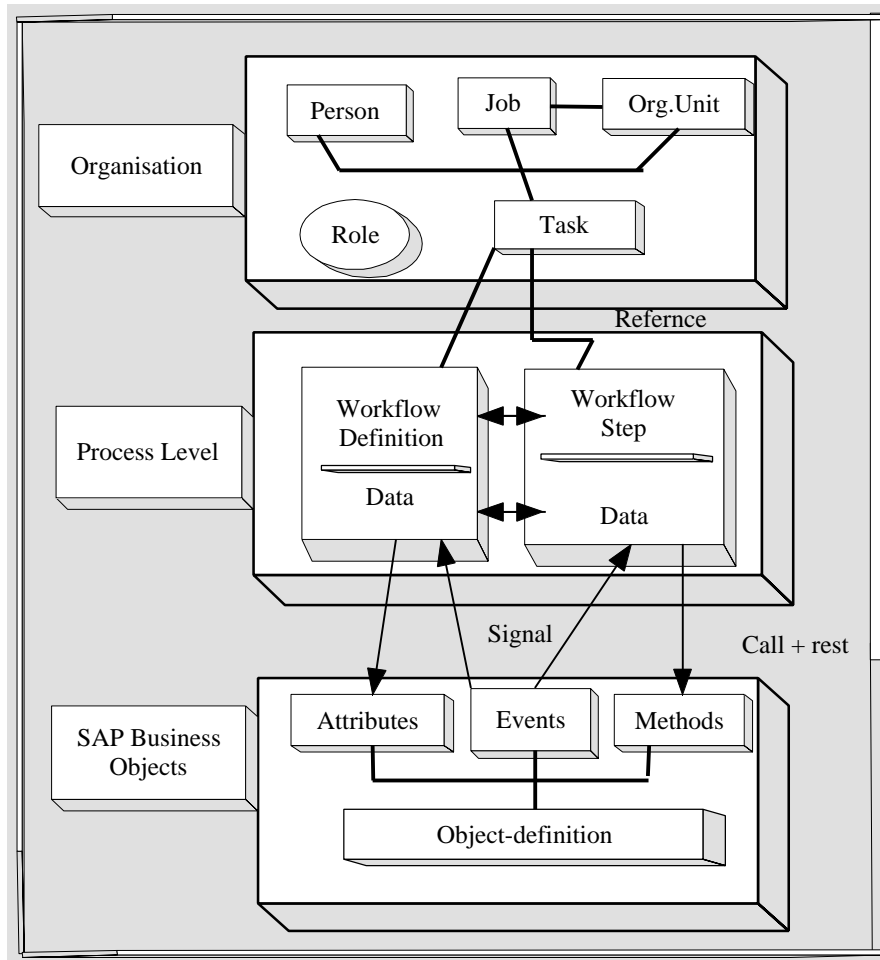


Figure 6 SAP Business Workflow¹⁵

4.13. On-line System

The Online Service System (OSS) is a free of cost R/3 service system that can be used by customers with a remote connection to SAP support servers.

The OSS provides the following services:

- Problem and information database: before calling SAP users can try to find a solution to a problem in the databases.
- Latest SAP news.
- Up-to-date release, installation, and upgrade information.
- Online assistance. Register problems or questions online.
- Training offerings and course descriptions.
- Access to SAP Software Change Registration.

¹⁵ www.sap.com (1998).

5 Lotus Notes Description

In this chapter, one finds explanations of the major features of Lotus Notes system such as the Client/Server connection and Lotus databases. Further this chapter will handle concisely the use of Lotus Notes in the major areas such as Mobilework and Internet.

5.1. What is Lotus Notes?

The idea to combine electronic mail with on-line conferencing was found by Ray Ozzie, a computer scientist from USA. He managed to get the chief executive of Lotus Development Corporation interested in his idea. The first version of Lotus Notes was released in December 1989. 1995 IBM bought Lotus.

Lotus Notes is a Client/Server system and the market leader in GroupWare technology that supports Communication, Collaboration and Coordination in organisations. It is used generally for Knowledge sharing and managing. The latest version today (January 1999) is R5.

5.2. The Client/Server-Connection

Lotus Notes works on most industry standard network protocols. The following figure shows Notes connections.

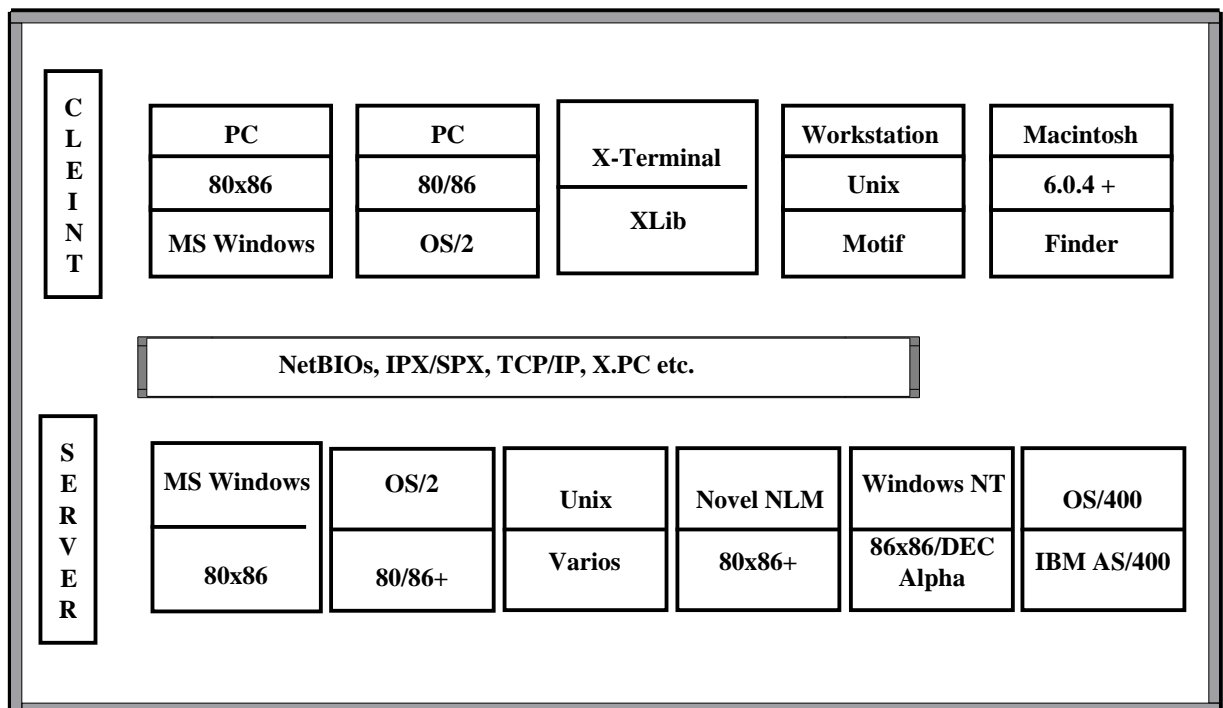


Figure 7 Lotus Notes Connection Scheme¹⁶

¹⁶ Peter Lioyd and Roger Whitehead (1996).

5.3. Lotus Databases

In Notes Databases every single element is saved as document. It is unlike traditional databases like MS-Access where data is saved in fields for example names, addresses etc. Documents can be books, information about customers or any kind of reports etc.

Notes database holds items of data as electronic documents. These documents represent series of forms that can be designed by the users. Forms consist of fields, which contain the data. These documents that were changed by users will be updated through replication.

5.3.1. The Domino Server

The Domino server transforms Notes into an Internet application server. It ties the Notes application environment to the Internet protocols and standards and lets Web clients participate in Notes applications using the Internet. It delivers messaging and GroupWare applications to Web clients. Domino includes an HTTP server and an engine that converts Lotus Notes applications into HTML.

5.3.2 Replication


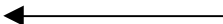
Replication is the process of distributing copies or replicas of a database throughout an organisation. Through replication users are allowed to add, delete and modify individual replicas and then the replicas are synchronised so that all replicas reflect the modifications in each replica. Users get a copy of the database either on a local Notes server or on a workstation and work with it. These copies will be updated in regularly periods so that the database will contain the latest modifications (see example below). This allows different users in different countries and in different time to share information. The servers connect each other in a scheduled time and changes will be registered.

Example:

Database 'Sales' in San Francisco
has documents A,C,D,F

Paris 'Sales' has documents
A,B,C,D,E

Replication:

San Francisco sends Paris "F"  Paris sends San Francisco "B","E"


In the example, replicas of the Sales database in San Francisco and Paris call each other to determine which documents are missing from which replica and quickly fill in the gaps with copies passed to each other.

5.4. Features of Notes Documents

Document is the fundamental unit in a Notes database. It can be as complex and "unstructured" as a paper document that we usually use, it could contain complex formatting or even images or anything that we can digitise.

View

A view is a listing of particular documents in a database. Depending on the needs of the organisation or the group that uses the database, the database can be organised differently in many views. The viewed structure has nothing to do with the actual structure of the document itself, it is a convenient way to display an overview of the documents in a Notes database.

Form

A form is a basic structure of a document. The form is the blueprint of the documents and the documents themselves are the result of the execution of the blueprint, the documents are identical in the structure but different in the content.

Subform

A subform is a form that is integrated into the design of another form (or subform). Developers can create consistent functionalities across several forms by programming the functionality into a subform and then inserting the subform into the forms as a single design object. Subsequent changes made to the subform automatically appear in all the forms in which it is used.

Fields

Fields are the basic containers in which data can be saved. Forms usually contain several fields, the value of the field is determined by the developer of the Notes document, it can be numeric or textual or a Rich text field. A Rich text field can contain formatted data as well as linked objects, graphics, and attachments.

Folders

Folders enable users to manage and organise documents in a database based on individual preferences. They are like the views in displaying a list of documents but differ in the way of user choices and not predefined selection of criteria.

Navigators

In order to access views in a specific way there is a possibility to build your own graphical navigator. This is called Navigation Panes, it is used in building your own environment specially by developing applications. It is a user-friendly feature of Notes.

Formulas

A formula is something that performs an action, which yields a result.

For example: a lowercase word is converted to uppercase, this is an action, which produces a result, and for this action Notes users can implement formulas that handle this event.

Formulas do not stand by themselves; they must always be associated with some design object- a field, a column, a button, and so on. A formula can be one or more expressions.

Agents

Agents are self-contained mini-programs that users can implement and use in variety of ways. The power of Agents lies in their ability to automate a series of operations. Notes has two types of agents; Personal and Shared.

Actions

Actions are workflow-oriented programming elements that provide an easy way to associate buttons with a form or a view. Conceptually, Actions are very similar to buttons that users place within a form, but they allow them to convey the flow of the applications more clearly by the virtue of their prominent presence with the note desktop.

Events and Events-driven programming

Every action performed by the user in Notes application is considered as an event, for example opening and closing a document, clicking a button etc.

Writing formulas and scripts that react to specific events is known as event-driven programming. Events are always related to the design object with which they are involved. Objects can *respect* an event or ignore it depending on the formula or the script associated with it.

5.5. LotusScript

LotusScript is an object-oriented programming language and development environment for Notes applications. It is BASIC-compatible and provides the following functions:

- Create structured programs.
- Incorporate iteration and flow control in programs to active precise direction over program execution.
- Manipulate databases, documents, fields, and other design elements.

Some actions must be programmed through Formulas others can be implemented with the use of LotusScript programming language (writing Script). A combination between the two ways gives the Notes developer control over Notes applications development environment. Writing formula and Script make the entire programming environment.

Here is an example for a formula:

The following formula closes an open document when a user clicks the Close Document button

```
@Command([FileCloseWindow])
```

The same example with a script

```

Sub Click(Source As Button)
    Dim workspace As New NotesUIWorkspace
    Dim uidoc As NotesUIDocument
    Set uidoc = workspace.CurrentDocument
    Call uidoc.Close
End Sub

```

A Class is a LotusScript programming construct that lets you record and retrieve information for an object (Notes structure) and take action relative to an object. In Notes environment, databases, documents, views, and Agents are examples of objects. Each object is derived from a class, which dictates an object's characteristics and the operations that can be performed in relation to it.

5.6. The Mobile Lotus Notes

Mobile Notes enable users to work when user workstations are not connected. It enables users to work interactively by calling a Notes server with a modem and remain connected while working with a database. There is another way to use Notes in mobile form that is to work with a Notes database and then when finished the job, replicate the changes. It is possible to work locally with exact copies of a shared database (working with your own replica) and send and receive mail by working on the own replica of the mail database. Before it can be possible to work mobile with a database, one has to call the server where the database is located in order to create a local replica of the shared database. When this is done, it is possible to work on the database without being connected to a Notes server.

5.7. Notes as GroupWare

In contrast to word processing, spreadsheets and other application forms that are designed for a single user, GroupWare applications are created for a group of people who want to organise and share information in an organisation. Notes is actually the market leader in this area and is used in many companies around the world. Notes enables users to share information in a way that satisfies their specific needs. It supports decision-making and spreading of ideas and critical thinking.

The basic functions for GroupWare-technology are:

- Communication
- Collaboration
- Coordination

For that matter, Notes is used for the supporting of communication when it is used as an Email system and for supporting collaboration when it is used in sharing documents among users and for supporting coordination when it is used in workflow automation.

5.8. Notes as E-mail

For the traditional mail systems, it is important how to send and receive messages. Lotus Notes functions in this way too, but additionally differs in the way that it collects messages in a shared location where users can access and use messages. Like traditional mail systems, Lotus databases are stored in servers but a difference is that Notes servers focus on document management, structure, categorising and a fast way to move messages.

5.9. Notes Workflow

A Business Process is the sequence of steps that is needed to achieve a particular goal in the context of a business environment. A business process describes *what* to be done and not how to do it.

The execution of the steps in a business process by the individuals involved in the process is called Workflow. Workflow Automation is the process of automates workflow. Notes applications are designed to support Workflow Automation but users have to have a good knowledge in order to accomplish this job.

5.10. Notes and the Internet

InterNotes News:

The InterNotes is a Notes application server through which articles can be exchanged between Notes and a news server using Network News Transfer Protocol (NNTP). Notes users can take part in Usenet newsgroups without the need to be connected personally to the Internet.

InterNotes Web Publisher:

InterNotes Web Publisher is a tool that converts Notes databases and documents into HTML, so that Notes users can use and publish information on the WWW from their Notes environment. The users can prepare their own information as an integrated part of the work. They can use the WWW no matter where they are and through the Replication documents will be changed and updated.

InterNotes Web publisher creates HTML code of the Notes views so that web browsers can use the rich text of Notes databases.

InterNotes Web Navigator:

The InterNotes Web Navigator allows users to integrate Internet resources into their business process applications. It converts and retrieves Internet content into Notes documents which then can be managed to be used easier and more valuable.

5.11. Notes Release 4.5

Lotus Notes release 4.5 provides users with the following functionalities:

- Notes databases store documents and information.
- Simple word processor allows group editing of database documents.
- Discussion forums take place through Notes documents.
- Documents libraries for Microsoft Office and Lotus SmartSuite let users create and share spreadsheets or presentations.
- Notes e-mail consists of mailed documents. The inbox is another Notes database.
- Integrated group calendaring and scheduling.
- InterNotes Web Navigator browser provides access to the Web from within Notes.
- InterNotes News 2.0 provides Notes users with access to both Internet newsgroups and internal newsgroup.
- Remote access and replication lets your computer call up Notes servers and download, or replicate, databases.
- Application development tools, such as the following let users create custom workflow application
 - ❑ Agents builders let users create agents to automate tasks.
 - ❑ Notes script language provides built-in functions like those in Lotus 1-2-3 spreadsheets and menu commands.
 - ❑ LotusScript is like Basic programming.
 - ❑ NotesFlow provides workflow tools.
 - ❑ Java applets and Internet plug-ins.
 - ❑ Lotus'Notes F/X 2.0 and Microsoft's OLE 2.0 for data transfer.
 - ❑ Notes Reusable Subform are forms you use alone or combined. They can contain rules for routing workflow or agents for automating tasks. By embedding LotusScripts or fields in them, they can perform operations.
- Tools to connect to relational databases and legacy transaction systems.

6. SAP/R3 and Lotus Notes in the BPR Process

- **SAP/R3**

In the past, systems were designed to give a snapshot of the business, they were designed for hierarchical control, local decision making, and financial accounting. These systems had the disadvantages of high costs, slow response times, and the inability to cope with changes.

Today, companies have to produce their products faster, better and cheaper. If they want to compete, they have to

- Take a global, value-chain perspective
- Adopt a business-process orientation
- Allow business optimisation

The R/3 system has an integrated Reference Model that supports continual business-engineering processes. These processes will be object-oriented modules that can be accessed through referencing. The inherent object orientation in R/3 makes it possible to have a standard system to implement different business processes, which in turn means that changes can be done.

Information technology and BPR are today very close to each other, that is why the term BPR in relation to IT has been changed to BE (Business Engineering). BE is a combination of the innovations of information technology with the concepts of BPR in managing better business processes. BE is now the radical, process-oriented, business solution, which is connected to information technology with its client/server computing. It makes companies more customer-focused and responsive to changes in the market. These changes will be implemented not by complete automation of a business but rather in process-oriented terms¹⁷.

R/3 is a product that runs on a process-oriented basis and that is why it fits well with reengineering processes. The principle of value-chain and business modelling can assist in redesigning business processes.

- **Lotus Notes**

Many companies around the world use Lotus Notes for the radical change (BPR) when they notice that they need to support their work with functionalities from the GroupWare technology.

ABB Asea Brown Boveri carried out a successful reengineering effort for supporting its multi-cultural knowledge sharing and communication. The company is divided into three regions – America, Europe and Africa, and Asia Pacific. They chose Lotus Notes for this job. Lotus Notes is now used for supporting projects from different Segments and business areas, different regions and countries and it has become a corporate

¹⁷ Tomas Curran & Gerhard Keller (1998).

resource rather than a tool or an infrastructure¹⁸. The Change was in the structure of the organisation including the IS-department. The company now is more customers close and the changes for achieving this goal are being made continually.

There are many reasons why companies around the world decide to innovate their work and transform their organisations through adopting Lotus Notes:

- To have a one firm culture where knowledge sharing can improve the competitive advantage of the organisation
- Adoption decision process with a database-centric solution
- Improve the communication between Staff and Customer
- The LAN and Lotus Notes can be used for broadcasting (distance teaching)
- Sales Force Management
- Computer-Supported Collaboration
- Workflow

There are surely more reasons why Notes can be adopted, but it is clear that Notes is an ad-hoc product.

¹⁸ Peter Lloyd and Roger Whitehead (1996).

7. Implementing SAP/R3 and Lotus Notes.

- *SAP/R3*

In the literature ¹⁹ we find the following major success factors that emerge by implementing complex systems:

- *Understand the corporate culture:*

It is important to understand the readiness for change and capability to do these changes in order to choose the right technical/business solution. The implementation will be more complex when many changes have to be done.

- *Begin process changes first:*

Before starting with the implementation of packaged software, it is useful to begin with business process redesign effort. In this effort, it is necessary to keep in mind the structure and the features of the software packages in order to identify new requirements that do not fit in the new system.

- *Communicate:*

It is necessary to communicate and inform employees (several times) at all levels about the changes that will be made by the new system, this will lead to less frustration in using the system in the future.

- *Provide Superior Championship:*

The management team has to be actively involved in the change process and consider it as a difficulty that they have to face and beat.

- *Ensure that the project manager is capable:*

It is best to blend organisational and technical solutions in the process of change, this is done by mixing managers with different skills.

- *Choose a balanced team:*

It is necessary to include experts from different sectors such as IS, order processing, manufacturing, sales and distribution etc. Since they will be the doers of the job in the process.

- *Select a good Methodology:*

Project leaders should set out clear, measurable objectives at the beginning of implementing complex systems and should control the process in time intervals.

- *Train everyone:*

Implementing a new system means that the way of the work will be changed, users of the new system have to be informed about *how to do the job*. The human resources Department will be involved in this issue too.

- *Commit to Change:*

In the implementation process old problems may arise several times in different places. That is why it is very important to take changes seriously and commit them in details so that they can be used in future arising of problems.

All these general success factors are valid in the process of implementing the R/3 system. Other aspects that are related specially to the implementation of R/3 are ²⁰:

¹⁹ Nancy H. Bancroft (1997).

- Let people learn by experimentation: set up a “sandbox” where people can make changes in R/3 tables, it is useful to let them understand what will happen and what will not with certain elements.
- It will be necessary to define or redefine business process changes prior to implementation, so that they fit the desired visions and the R/3 structure.
- Customise, do not modify since R/3 is very rich, it is important to choose between the thousands of business objects and not to modify or invest in writing software.
- Since R/3 is a centralised, top-down, structured approach, it may not support the business structure or the information architecture that a company needs, it will work better if it will be operate within these limits. No company will provide a 100% solution.
- Training is only the Beginning: even if people train for some weeks in R/3 modules, experience shows that people need a year or more to configure a major module. Team members will need to continue to make experiments in their own environment in order to know what the system really offers.
- When customising SAP/R3 for the BPR process, it is necessary to choose the team from the manager or supervisory positions. They will choose the tables that fit to how work was done. Choosing leaders within the team is another important point, the leader must know how to fit R/3 to the new way of work. Teams without leaders try to use the R/3 in a manner that is like the old way of work.

The first two steps are to choose which modules are to be selected and where to implement them. It is not useful to implement the entire system, corporations usually choose either a suite of modules for a major business segment, or implement all modules for a Strategic Business Unit (SBU). These companies then move onto the next SBU, or add functionalities.

- ***Lotus Notes***

Implementing Lotus Notes means adopting GroupWare technology, because as we know Lotus Notes is market leader in this area. There are a lot of implementations of Lotus Notes around the world, they are mostly successful efforts but there are failures to be found too ²¹.

Implementing Lotus Notes means building up infrastructure for managing documents in corporations, which means changing the way of work in organisations. One of the major functionalities that is offered by *good* using of Lotus Notes is the knowledge sharing and expertise change.

Documents will be saved in databases and everyone in the organisation can open and read them. This is a very sensitive issue by adopting this technology, since people do not like to show *what they can* because of the competitive situations they are living in. This is actually the case in many organisations culture, employees are afraid to be

²⁰ Nancy H. Bancroft (1997).

²¹ Ulf Essler (1998).

revealed by managers or others with higher positions in the hierarchical structure of the organisation about *how they do their work*. This is mentioned as the cognitive responsibility²².

Other properties that are offered by using Lotus Notes are the cooperation and collaboration. The real use of these properties depends totally on the culture and needs of the organisation. In the chemical-industry for example there is a need for project work and exchange of knowledge and that is why GroupWare was successfully implemented in this industry. Some companies implement Lotus Notes without knowing much about it, these companies usually use Lotus Notes as a mail-system or just for individual use in the same way that traditional software is usually used as *one user software*²³. Teaching Lotus Notes is sometimes problematical for companies because it is normally up to the users how they want to use it. A full use of Notes means, using it for communication, cooperation and collaboration.

²² F. Ljungberg, Sorensen C. (1995).

²³ C.U. Ciborra (1996).

8. SAPs and Lotus Notes New Technologies

8.1. SAP

SAP invests a lot of money in research and development. The following is a very short summary of some of SAPs new technologies:

8.1.1 Application Link Enabling (ALE)

ALE is an initiative taken by SAP with the aim of integrating business processes in distributed application environment. It is a concept for an effective reengineering. It makes business and technological innovations for business-process-driven communication available between technically independent applications. The ALE technology is based on controlled, timely exchange of business messages. Synchronous and asynchronous communication mechanisms are the basis for demand-driven application integration. This eliminates the need to a central database.

Since the approach of using “distributed databases“ in connection with distributed application systems is still not practical, and the EDI inflexibility, new initiatives with new features such as ALE are required. ALE has the following features:

- Release independence.
- Simple maintenance.
- Reduced complexity.
- Flexibility.

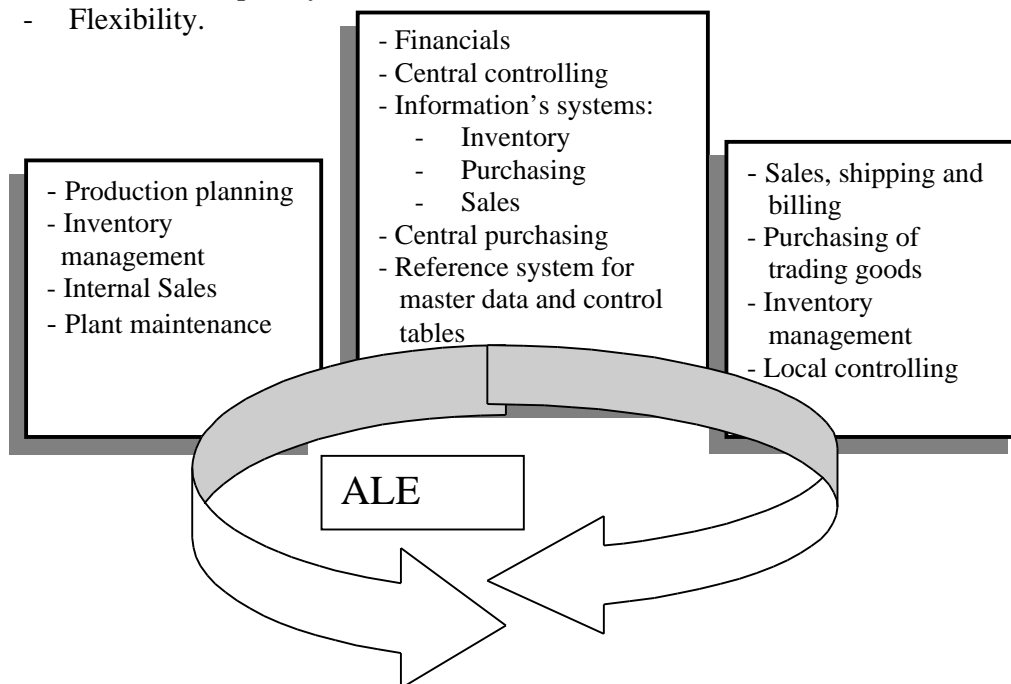


Figure 8 Organisational units in a company²⁴

²⁴ www.sap.com (1998).

8.1.2 Sales Force Automation (SFA)

SFA is an initiative taken by SAP in 1996. It is a part of the Business Framework. SFA is used to automate the day-to-day processes of the mobile sales force. Sales people are given tools to anticipate and quickly respond to the demands of the customer. The SAF is a tool that synchronises the communication and activities of sales representatives, managers, and selling teams with other departmental functions within the enterprise.

SAF has the following functionalities:

- Customer/Prospect Management
- Contact Management
- Activity Management
- Calendar
- Opportunity Management
- Order Management
- Quotations
- Marketing Encyclopaedia
- Sales Pricing Engine
- Sales Configuration Engine
- Promotions/Campaigns
- Customer Agreement
- Inbox, Outbox, Email

8.1.3 BAPI (Business Application Programming Interfaces)

Release SAP/R3 4.5 contains about 1000 BAPIs, which represent methods of more than 250 Business Objects. These BAPIs can be invoked from COM/DCOM and CORBA. Development environment such as the Visual Studio of Microsoft, the Access Builder for R/3 from IBM ships the BAPIs and Business Object definitions with their products. (See figure on next page)

BAPIs are standardised methods of SAP Business Objects that enable customers and third parties to integrate their software components with the R/3 System and the Business Framework. An external access to R/3's data and processes is only possible through the BAPIs (Business Application Program Interfaces).

A BAPI is defined as a method of a SAP Business Object. For example, the functionality that is implemented with the SAP Business Object Type (class) 'Material' includes a check for the material availability. Thus, the Business Object type 'Material' offers a BAPI called 'Material.CheckAvailability'.

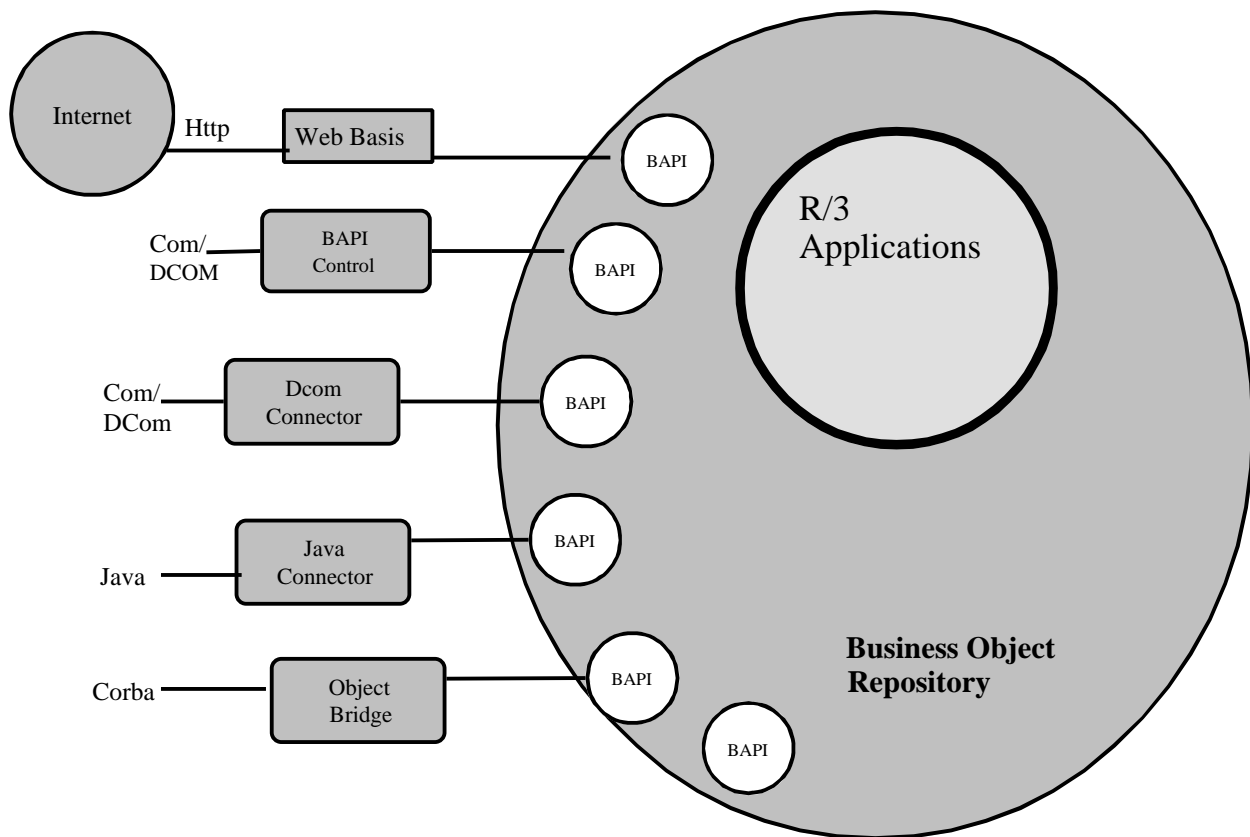


Figure 9 Business Application Programming Interfaces (BAPI)²⁵

To use a BAPI method, an application program only needs to know how to call the method; that is, it needs to know the method's interface definition. Therefore, when including a BAPI invocation in your application program, you only need to supply the appropriate interface information. A BAPI is defined by:

- Import parameters, which contain data to be transferred from the calling program to the BAPI.
- Export parameters, which contain data to be transferred from the BAPI back to the calling program.
- Import/export parameters for both importing and exporting data.

Using the BAPIs is advantageous because of:

- **Business Standard:**
SAP Business Objects and their BAPIs provide a business content standard, rather than a technical interoperability standard; that is, they enable the integration of R/3 and other software components on a business level, not on a technical level.
- **Standards Conformance:** You can access SAP business Objects and their BAPIs by using object-oriented interfacing technologies such as Microsoft's COM/DCOM.

²⁵ www.sap.com (1998).

- **Stability and Downward Compatibility:** Once a BAPI is implemented and released by SAP, its interface definition and parameters remain stable in the long term.
- **Object Orientation:** BAPIs can be called using object-oriented interfacing technologies, such COM/DCOM, thus enabling software components from SAP and third parties to interact freely.
- **Openness:** You can access BAPIs from all development platforms that support the Remote Function Call (RFC) protocol.

8.1.4 Advanced Planner & Optimizer (APO)

Supply Chain Optimisation Planning and Execution (SCOPE) is a new initiative taking by SAP in order to combine R/3 execution system, the business intelligence in Business Information Warehouse, and a powerful new analytical engine. It is a combination of execution of real-time decision making, and analytical decision making.

The new dimension of Enterprise Resource Planner (ERP) is one that involves people. Today, a whole new set of people must gain access to and be involved in the day to day operations of the enterprise. Interaction between salesmen, planners, suppliers, customers and even consumers has become more critical to an organisation's success. The SCOPE brings these people closer to the enterprise, enabling businesses to integrate information and decisions from the entire supply chain into an automated and optimised execution environment.

APO is a key component of the SCOPE initiative. It builds on SAP's Business Framework to improve information flow and incorporate real-time collaborative decision support, advanced planning and optimisation into R/3 System. APO has the following areas of functionality:

- *Supply Chain Cockpit:* A graphical instrument panel for modelling, navigating and controlling the supply chain.
- *Demand Planning:* A toolbox for statistical forecasting techniques and demand planning features to create the most accurate forecasts.
- *Supply Network Planning:* A planning approach to create tactical plans and sourcing decisions that takes the complete supply network into consideration.
- *Deployment:* A planning tool to rebalance and optimise the distribution network at execution time and create optimal truckloads.
- *Production Planning:* Rapid-Response Production Planning using dynamic optimisation techniques to generate executable plans.
- *Detailed Scheduling:* Real-time scheduling for finite sequencing and final assignment of production resources to create an optimal production schedule.
- *Global Available-to-Promise:* Multi-level, rules-based availability checking that considers allocations, production, transportation capacities and costs in a global environment.

8.2 *Lotus Notes*

New interfaces in the release 5.0 of Lotus Notes and Domino make Notes and the Internet closer. Web integration now lets Notes become more from the browser type. Java, JavaScript and HTML are now used to improve the existing Domino application. Notes programmers are working to include:

- Integrated support for the Internet standards.
- New Web Navigator features, including support for frames, animated GIFs, and the ability to the HTML source code.
- Improvements for task management, support for alarms, holiday support.
- New enterprise directory.
- Improvements for Web applications, including support for native HTML support, CORBA-standard distributed objects, and third-party design tools.
- Shared resources, a new element that allows the pasting of an image or an applet into the shared resources area and calls it by name in an application.

Lotus Notes has a support for most of Internet standards such as POP3, SMTP, IMAP, NNTP, HTML, MIME, and LDAP. It offers different mail-services depending on the Internet standard that is used.

8.2.1 Notes relation to Java

The InfoBus is a set of standard Java interfaces that can be implemented as extensions to any Java applet, JavaBean or component. InfoBus technology underlies all of Lotus' eSuite components, allowing data to flow between them. Data can also be accessed by custom InfoBus-enabled components developed by customers or Business Partners.

Lotus eSuite is a new class of Java - based business productivity software. It contains of two products, **eSuite WorkPlace** and **DevPack**. These two products helps users make the most of their networks, build more powerful applications, and deliver task oriented applets to more users inexpensively.

eSuite WorkPlace is a set of, fast, easy-to-use business tools for end users that are distributed from a central server. WorkPlace includes a complete set of business productivity applets including spreadsheet, word processor, and presentation graphics.

eSuite DevPack is a set of Java-based applets that can be used as modular building blocks by Intranet application developers to quickly and easily create more interactive and dynamic Web applications accessible via standard Web browsers. The DevPack includes the following applets; spreadsheet, word processor, presentation graphics project scheduler, chart, SQL/JDBC, and CGI gateway; plus sample applications, utilities, and developer documentation.

9. Discussion

From the previous descriptions we notice the following differences:

- While process-orientation is the major concept for the R/3 architecture, Lotus Notes can be used for doing work in process-oriented methods.
- SAP/R3 is used extensively in the commercial sector. But it is also used for control purposes in the manufacturing process. Human Resource module is an important part of the R/3 system, many companies made use of it. On the other hand, Lotus Notes is usually used for supporting groupwork, knowledge sharing, project control, calendar and Scheduling. Managing human resources is a very important functionality in Lotus Notes too.
- While SAP/R3 data is highly structured, Lotus Notes data is unstructured and from rich data type.
- R/3's data processing is transaction oriented, while Notes data are documents and intelligent forms.
- SAP and Lotus use 4GL developments environment for developing applications or modules. ABAP4 is used by SAP for this purpose while Lotus uses Lotus Script for the same purpose.
- Depending on the needs of companies, implementing R/3 can be difficult because of its richness with a huge number of modules. In contrast, Lotus Notes technical implementation is not that difficult but the appropriate use of it represents the difficulty. Many companies implement it without having knowledge about how to use it.
- Lotus Notes can be integrated with other products and in different platforms. SAP/R3 does not have this feature, but SAP works on improving it so that it can be integrated with other products and be a part of a software-office.
- Using R/3 or Notes in BPR efforts means changing the way of *how work is done insides companies*. R/3 lets business processes communicate with each other so that work will be done smoothly. Lotus Notes changes the way of work in the sense of giving new opportunities and improvements for the teamwork in- and outside the company.
- Lotus Notes is used on the Internet as infrastructure while R/3 is used as transactions.
- With latest development in the technology and using R/3 or/and Lotus Notes, Companies get opportunities to be on the Internet with security offered by R/3 and Notes.
- It is very important today to have a strong infrastructure in order to meet changes in technologies. R/3 and Lotus Notes are technologies, which can be relied on because of their abilities in adopting and developing technologies. I am thinking of transactions like voice, movies, and E-commerce.
- SAP/R3's Oracle databases are centralised and based on the relational database concept, Notes databases are the lotus Domino distributed databases and the updating process is based on the replication concept.
- While SAP/R3's online processing is the service interface with customers, Notes services are mobile, remote and LAN.
- Business processes are defined in R/3. Notes business processes are ad-hoc.

10. Lotus Notes connection to SAP/R3

Enterprises around the world select SAP's R/3 and Lotus Notes for their reengineering and information processing strategy. The combination of SAP R/3 and Lotus Notes gives companies a substantial value for managing information and make it possible to extend information sharing to enterprise Intranets and the Internet. Lotus Script extensions (LSX) for SAP R/3 is the object oriented plug-ins for Lotus Script that enables integration of Lotus products with the SAP system.

There are two classes of integration technologies possible between Notes and R/3:

- End user Interface: end users can analyse, enhance and distribute R/3 report data using Lotus Notes and Domino. They can generate reports and select the Lotus application into which R/3 will load the data and contextual information.
- Developer tools: programmers get links to build applications that link R/3 to Notes and Domino. R/3 business objects or BAPIs are made directly available to the Notes developer.

The Domino connection with LSX for R/3 offers:

- Improved analysis of R/3 data:
Updates, manages and distributes data across the enterprise, this eliminates geographic boundaries related to enterprise's wide collaboration efforts.
- Improved reporting of R/3 data:
R/3 output can be created, maintained and distributed through existing Lotus Notes infrastructure.
- Access to R/3 information via Web browsers:
Makes R/3 data available via inter/intra networks, utilising widely accepted and existing user interfaces.
- Support for remote and mobile users:
R/3 reports and extracted data can be stored in Lotus Notes databases allowing remote and mobile users access to R/3 information locally while they are not connected to the network.

With LSX, ABAP/4 programmers can access Notes functionalities from within R/3. This allows programmers to open a Notes database, create documents, add and change data etc.

The SAP R/3 Remote function Call (RFC) is similar to the remote procedure call that has existed in client-server environments for several years. It gives external systems the ability to execute transactions on the R/3 server. This feature opens the R/3 System to all the existing systems in a customer's environment. With RFC, using lotusScript, Notes applications can retrieve and submit data from R/3 system to Notes system.

With LotusScript, programmers can access SAPs business objects (BAPI's) from a remote source such as Internet.

The following are some of the benefits resulting from Lotus Notes connection to SAP/R3 indicated by Lotus and SAP:

- Creating Business Web Sites.
- Remote Sales Force Automation.
- Employee Access to HR Information.
- Customer Service and Support.
- Distribution of Reports and Data.
- Field Site Data consolidation.
- Integrating Quality Management Processes.
- Expense Reporting and Tracking.
- Budget Analysis and Approval process.

11. Conclusion

As a result of my work, I found that SAP with its R/3 and Lotus with its Notes do not compete with each other with the major functionalities that they offer. In contrast, they complement each other as is mentioned by the two companies. Since a few years ago the two companies are partners and support each other's products. They might compete in the area of Workflow Management, but enterprise's needs are the decisive factors that determine which of the products are to be chosen. The two products do not exclude each other.

Notes security with support for disconnected users and the remote function call was of interest for SAP/R3. That is why they worked with the integration of the two products through the LSX (Lotus Script extensions), which gives Notes users the ability to access R/3 databases and use its tables.

Mixing process-orientation with GroupWare support is a very interesting concept that gives enterprises new opportunities, and makes documents management more efficient. Notes strength in HR-management can give R/3s HR-module strong support, by using R/3s structured data, for managing personal in enterprises all over the world.

Since SAP/R3 is used as a standard system for managing documents, it changes the culture of enterprises, which means that the decision of adopting SAP/R3 is very complicated. Usually, benefits of adopting SAP/R3 will be noticed a while after the complete implementing of the system. This fact makes decisionmakers further unsure.

One of the strongest benefits of adopting SAP/R3 System is the fact that enterprises will have the same culture in their sites around the world. Because of the standardisation of their systems, this in turn will result in efficient use of the online system with its simultaneous updating.

Today, there is a lack of SAP/R3 experts, which means some fear of adopting this technology but SAP is working on guaranteeing their support for those who want to adopt the technology.

The benefits of using structured data for statistical calculations, processes coordination, standard systems etc, balances the *unfreedom* of action and the less collaboration that we have to face when using these data. With Notes *unstructured* data we have more freedom of action and the strength of the collaboration but less possibilities to jobs like statistical calculations and Business Workflow.

12. Appendix A

Abbreviations

ALE	Application Link Enabling
BAPI	Business Application Programming Interfaces
BO	Business Object
BPR	Business Process Reengineering
CGI	Common Gateway Interface
CO	Controlling
COM	Component Object Model
DCOM	Distributed Component Object Model
CORBA	Common Object Request Broker Architecture
DLL	Dynamic Link Library
EC	Enterprise Controlling
GUI	Graphical User Interface
IM	Capital Investment Management
IMAP	Internet Mail Access Protocol
HR	Human Resources
HTML	Hypertext Markup Language
LDAP	Lightweight Directory Access Protocol
LSX	Lotus Script extensions
MIME	Multipurpose Internet Mail Extensions
MM	Manufacturing and Logistics
NNTTP	Network News Transport Protocol
OOP	Object Oriented Programming
OLAP	Online Application Protocol
OLTP	Online Transactions Processing
PM	Plant Maintenance
POP3	Post Office Protocol
PP	Production Planning and Control
PS	Project Management System
QM	Quality Management
RFC	Remote Function Calls
SD	Sales and Distribution
SFA	Sales Force Automation
SMTP	Simple Mail Transport Protocol
TR	Treasury

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14. Bibliography

- A. Ljungdahl (1996) **Lotus Notes som Verktyg i Systemutvecklingsprojekt**, Examensarbete, Institutionen för Informatik, Göteborg.
- Bo Dahlbom and Lars Mathiassen (1993), *Computers In Context*, Blackwell, UK.
- C.U. Ciborra (1993) *Teams, Market and Systems*, Cambridge: Cambridge University Press.
- C.U. Ciborra (1996), *GroupWare and Teamwork*: Invisible aid or technical Hindrance?, Wiley, UK.
- David Coleman, Roman Khanna(1995), **GroupWare, Technolgy and Application**,Perntice Hall PTR, USA.
- F. Ljungberg, Sorensen C. (1995), *The Push & Pull Profession*:Practitioner Perspective on Lotus Notes Initiation. Department of Informatics,University of Gothenburg, Sweden, Department Risö National Laboratory, Denmark.
- F. Ljungberg (1997) **Networking**, PH. D. thesis, Department of Informatics,University of Gothenburg, Sweden
- Ian Sommerville (1995), **Software Engineering**, Fifth Edition, Addison Welsley.
- J. Ljungberg (1997), **From Workflow to Conversation**, PH. D. thesis, Departmentof Gothenburg, Sweden
- José Antonio Hernández (1997), *The SAP R/3 Handbook*, McGraw. Hill, USA.
- Kenyon Brown. Kyle Brown. Francios Koutchouk. Kevin Brown (1996), *Mastering Lotus Notes 4*, Sybex, USA.
- Nancy H. Bancroft, Henning Seip, Andrea Sprengel (1997), *Implementing SAP/R3*: How to introduce a large system into a large organisation, Mmanin Pub. Greenwich.
- Peter Lloyd and Roger Whitehead (EDS), (1996), *Transforming Organisation Through GroupWare* : Lotus Notes in Action, Springer, UK.
- Thomas Andersson, Andera Wohrm (1997), *Netscape och Lotus Notes som Intranet Verktyg*: Jämförelse av verktygen för en Intranet presentation av en avdelning på Volvo Data, Göteborg Universitet.
- Thomas Curran & Gerhard Keller with Andrew Ladd (1998), *SAP R/3 BusinessBlueprint*: Understanding the Business process Reference Model, Prentice Hall,New Jersey.

Ulf Essler (1998), ***Analysing GroupWare Adoption***: A framework and three case Studies in Lotus Notes deployment, PH. D. thesis at DSV Department of Computer Sciences, Stockholm University.

Wanda J. Orlikowski (1992), **Learning from Notes: Organisational Issues in GroupWare Implementation**, Sloan School of Management, Massachusetts Institute of technology, USA.

World Consultancy and Jonathan Blain (1997), **Special Edition, USING SAP R/3,SECOND EDITION**, QUE, USA.

HTTP:// www.lotus.com

HTTP:// www.sap.com

HTTP:// www.ibm.com

